

EDITORIAL ARTICLES.

THE PATHOLOGY OF PERITONITIS.

An important study of the mode of action of micro-organisms in the causation of peritonitis, which also teaches many important surgical lessons, has been recently made by Grawitz.¹ Wegner's well-known researches² laid the foundation of our modern knowledge of peritonitis, and it is necessary first to give a brief review of his results. Wegner concluded that the important factors in peritonitis were the immense superficial area of the peritoneum, the large amount of fluid it is capable of exuding, and the large amount it can absorb. By his experiments on rabbits, he found that ordinary atmospheric air and various fluids (such as serum, bile, even urine), when introduced into the peritoneal cavity, are simply absorbed and do not produce peritonitis. Any solid particles in the fluids were encapsulated. When air and putrescible fluids were introduced together in a quantity greater than could be absorbed in a short time, decomposition set in, its products were absorbed, and the animal died of septicæmia. He found one remarkable exception—living defibrinated blood never decomposed under these circumstances. He concluded that the dangers in peritoneal wounds and inflammations were those of septicæmia, for in no case did he succeed in producing peritonitis. But his results apply only to the peritoneum as forming one of the cavities of the body. Grawitz has studied it as one of the tissues, as capable of inflammation.

In all Wegner's experiments the effects were due to the micro-organisms of decomposition—those of suppuration were then unknown. It is now settled, however, that suppuration cannot be caused by chemical

¹ "Statistischer und experimentell-pathologischer Beitrag zur Kenntniss der Peritonitis."—*Charité-Annalen*, XI. Jahrb., 770.

² *Langenbeck's Arch. f. klin. Chir.* Bd. XX., 1, p. 51.

reagents, and we can assert that wherever there is pus, micro-organisms have been at work—and usually certain specific varieties. So Grawitz finds that a large number of species of micro-organisms do not cause suppurative peritonitis when introduced into the peritoneal cavity, and that even the specific pus-producing forms can cause suppuration only under certain conditions.

The results of Grawitz's experiments on animals are as follows:—The introduction into the healthy peritoneal cavity of rabbits, of the ordinary forms of micro-organisms (even in large quantity), of the same together with putrescible albuminous substances (spleen-pulp), of cholera-bacilli, and even of fecal matter—produced no peritonitis, if the quantity was not greater than the peritoneum could absorb or safely encapsule in a limited time—about one hour. When the absorptive power of the peritoneum had been impaired, the same agents were more slowly absorbed, but produced no peritonitis, although septicæmia resulted if the micro-organisms had the power of decomposing albumen. Pure cultures of micro-organisms capable of producing suppuration, provided the injected fluid was not chemically irritating, and not too great in amount (not much over 10 ccm.), produced no inflammation in a normal peritoneum. But they did produce suppurative peritonitis under the following conditions:—

(a.) When stagnant fluid was present, capable of nourishing the micro-organisms (salt-solution, bouillon)—the bacteria developing more rapidly than the peritoneum could absorb them.

(b.) When caustic solutions had prepared a field for the growth of the micro-organisms by destroying the surface of the peritoneum.

(c.) Especially, when a wound of the peritoneum was present—even the hypodermic puncture made in introducing the cultures may be the starting-point of peritonitis.

Grawitz then adds a statistical study of the post-mortem examinations of 867 cases of peritonitis. He agrees with Leyden,³ that "idiopathic" peritonitis can occur only when the pus-producing micro-organisms have implanted themselves in some part of the body from

³ Deutsch. med. Wochenschr., 1884, No. 17.

which they can invade the peritoneum ; but he makes the further conditions, that there must also exist an injury of that membrane, or a stagnant fluid in its cavity beyond its powers of absorption.

" Taking cold " is the most frequently assumed cause of idiopathic, or rheumatic peritonitis. To test the effects of cold, Grawitz shaved and poulticed the abdomen in rabbits, and then suddenly exposed it to a draught of ice-cold air ; but the animals gradually recovered without feeling any ill effects from the exposure. Equally negative in results were similar experiments preceded by the introduction of pus-producing micro-organisms into the intestinal canal, or into the peritoneal cavity. When they were introduced directly into the blood-circulation, abscesses in the heart-muscle, with suppurative pericarditis, pleuritis, and peritonitis were, indeed, produced—but never peritonitis alone. He, therefore, concludes that exposure to cold cannot be considered a true cause of peritonitis, although it may be accessory by disturbing the local circulation, or by increasing peristalsis—which might hasten the perforation of an intestinal ulcer.

Grawitz explains the frequency of idiopathic peritonitis in women about the menstrual epoch as due to the implantation of micro-organisms upon the newly opened Graafian follicle in the ovary, which supplies the necessary break in the surface of the peritoneum, reminding us that the micro-organisms may reach this spot by the circulation of the blood from a distant part of the body (a tonsillitis, for instance) as well as through the uterine canal. But the second predisposing cause is much more frequently at hand in idiopathic peritonitis—the presence of a stagnant fluid in the peritoneal sac, caused, for example, by cirrhosis of the liver, or by nephritis.

Peritonitis from perforation of the hollow viscera has a better prognosis than puerperal peritonitis, for proofs of its former existence and recovery are frequently discovered at autopsy. The danger in these cases depends upon three factors :—the quality of the extravasated material ; its quantity, which is even more important, for if it oversteps the absorptive power of the peritoneum septicæmia, or peritonitis, or both are unavoidable ; and the character of the perforating process—most important of all, according to Grawitz, as his experiments show

how dangerous to the peritoneum is a spot upon its boundaries where micro-organisms can take root. Because bacterial colonies exist in the tissues surrounding an ulcer, while the edges of a traumatic perforation are uninfected, Grawitz considers the prognosis in the latter case the better of the two. Rupture of the bladder, in particular, should have a good prognosis, provided laparotomy was done before the slow absorption of urine had gone too far, and before infection had been caused by use of the catheter. For fear lest this supposition as to the less gravity of the prognosis in traumatic cases do harm to the cause of early operative interference, in spite of the recommendation of laparotomy which accompanies it, we feel compelled to indicate that in practice two peculiarities of traumatic perforation quite overshadow this theoretical point in its favor. These peculiarities are the shock caused by the injury or by the sudden entrance of urine or feces into the peritoneal cavity—a shock which is in many cases of rupture of intestine the immediate cause of death; and the much more rapid spread of peritonitis in an abdomen free from the peritoneal adhesions so common in cases of perforating ulcer. These two facts are enough to justify the accepted opinion that the prognosis is worse in traumatic perforation than in non-traumatic.

Grawitz calls attention to several cases of fatal peritonitis following tapping for ascites, in order to emphasize the necessity of taking every antiseptic precaution in this little operation, as the presence of the fluid and the impaired absorptive power of the peritoneum increase the danger of infection.

In peritonitis from strangulated hernia and intestinal obstruction, the local disturbances of circulation alone may cause ecchymosis, fluid or even fibrinous exudation—in fact an *anatomical* peritonitis; but decomposition or suppuration are not present, and there is no danger of exciting suppurative peritonitis by returning the constricted loop to the abdominal cavity. But if the tissues of the gut are invaded by micro-organisms, they may easily penetrate the entire thickness of its wall, and are liable to spread thence and cause general suppurative peritonitis. In fact, the reposition of a loop of intestine in this state is even more dangerous than the return of a loop with a small accidental

perforating wound, but with its tissues uninfected. Experiments on rabbits show that excessive distention of the intestines by complete obstruction may of itself produce death, just as in man, but cannot produce peritonitis, although the diminished movements of the diaphragm and intestines certainly favor its occurrence by reducing the absorptive power of the peritoneum. If, however, there is the least break in the continuity of the intestinal wall, even a superficial ulceration of the mucous membrane, micro-organisms will find an entrance, penetrate to the peritoneum, and peritonitis will follow.

Grawitz finds that tuberculous peritonitis is governed by the same laws as suppurative—both being due to micro-organisms. Therefore the same conditions favor the primary tuberculous forms, and the idiopathic suppurative peritonitis, and he gives a case in which ascites from cirrhosis of the liver was the predisposing cause for a primary tuberculous infection of the peritoneum. The secondary form is accordingly due to direct infection of the peritoneum by some neighboring tuberculous point.

Of the many practical deductions as to abdominal surgery to be drawn from this important essay we have room only to mention the necessity of avoiding raw surfaces in the peritoneal cavity, of a thorough toilet of the peritoneum, and of drainage in every case where any accumulation of fluid is likely to occur.

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GASTROTOMY FOR FOREIGN BODIES.

1. Gastrotomie wegen Fremdkörper. Von Dr. B. Credé. *Archiv.f. klinische Chirurgie*. Bd. XXXIII. Hft. 3.
2. A case of Gastrotomy, Digital Exploration of the Œsophagus, and Removal of Plate of Teeth. Recovery. Remarks upon the Operation and Observations upon the Anatomy of the Œsophagus. By Maurice H. Richardson, M.D. *Boston Med. and Surg. Jour.* 1886. Dec. 16.
3. A Successful Case of Gastrotomy, with Critical Remarks. By Augustus C. Bernays, M.D. *Medical News*. 1887. Jan. 1.

During the year 1886 four cases occurred in which foreign bodies, that had been swallowed, were removed from the stomach by means